Deep UV Raman/Fluorescence (DUV-RF) Stand-Off Sensor for Lunar Science

Photon Systems

Technical Abstract
This Phase II proposal is to develop a miniature, low power consumption, fused deep UV Raman and native fluorescence (DUV-RF) 1 meter stand-off sensor. The proposed instrument has an enhanced ability to measure the spatial distribution of chemical species containing C/N/H/O/S/Cl, and water, ice, and hydrated-minerals on a 1-5 mm spatial scale enabled by a novel wide-aperture, high-sensitivity ultraminiature UV Raman spectrometer. Raman spectroscopy is a non-contact, non-destructive, method of identifying unknown materials without sample acquisition or processing; ideal for in-situ rovers. However traditional Raman instruments are plagued with fluorescence backgrounds, require sample altering, high-powered lasers, and require the use fiber optics; an instrument design with operational constraints and high power requirements. Our innovative instrument design incorporates our deep UV lasers for fiberless resonance Raman spectroscopy in a fluorescence free zone where resonance effects lead to enhancements by > 2-3orders of magnitude over 532 and 785 nm systems and can be coupled to native fluorescence for ppt detection of aromatic organics compounds. The New Frontiers has placed a South pole-Aitken Basin sample return as a future mission scenario. The enhanced detection capabilities of DUV-RF can be used to provide an understanding of organics and water distribution in the lunar regolith.

Company Contact
William Hug
(626) 626-6431
w.hug@photonsystems.com

2008 Phase II
Proposal S1.11-9152

X-Ray Diffraction and Fluorescence Instrument for Mineralogical Analysis at the Lunar Surface

inXitu, Inc.

Technical Abstract
We propose to develop LUNA, a compact and lightweight X-Ray Diffraction (XRD) / X-Ray Fluorescence (XRF) instrument for mineralogical analysis of regolith, rock samples and dust, in lunar surface exploration. LUNA is based from the concept of CheMin, the XRD/XRF instrument of MSL, but is redesigned to provide a more compact unit at much reduced costs. Many details of LUNA derive from the designs of a small portable XRD/XRF instruments developed and marketed by inXitu. Bringing LUNA to TRL 6-7 is possible within the scope of this Phase II because key components have been or are being developed. Phase 2 addresses the missing critical subsystems: a low-cost flight-qualifiable X-ray CCD, and flight-qualifiable electronics to drive the detector and control the instrument. LUNA is not frozen in a particular geometry or mechanical implementation, it is meant to be flexible to answer the specific needs of any lunar mission. Transmission or reflection geometries are possible as demonstrated by inXitu's commercial instruments. Phase 2 will demonstrate a reflection version of LUNA operating under vacuum. This work leverages on the extensive experience of the PI and the company with XRD-XRF instrumentation in terrestrial and planetary applications.

Company Contact
Philippe Sarrazin
(650) 799-2118
psarrazin@inxitu.com

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